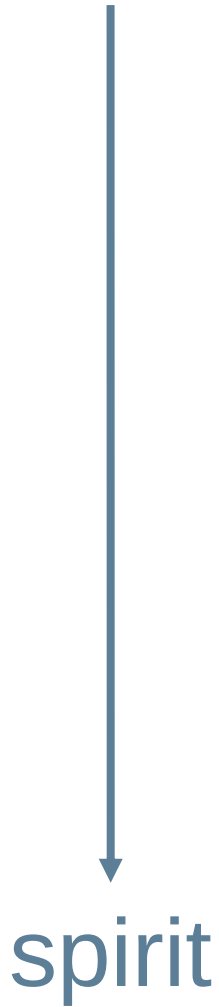


Session 2

Key principles of spirits production

An overview of spirits production

raw material



- 1** processing the raw material
to create a sugary liquid
- 2** alcoholic fermentation
to create ethanol and congeners
- 3** distillation
to select and concentrate ethanol and some congeners
- 4** post-distillation operations
to adjust colour, aroma, sweetness and alcoholic strength

Processing the raw materials

Aim

- to create a sugary liquid

Raw material provides

- carbohydrates for fermentation
 - fermentable sugars, starch, fructans
 - starch and fructans must be converted to fermentable sugars
- a unique set of aromas
- congeners = aromas/flavours

Processing starch

starch granules

unpack the starch granules

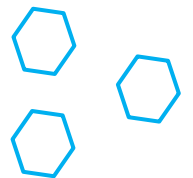
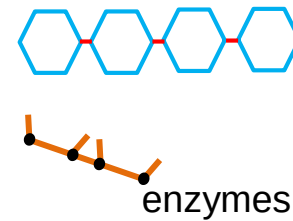
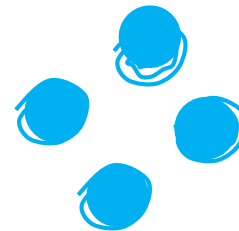
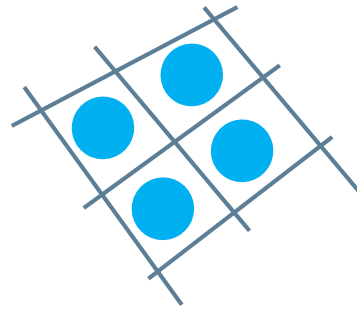
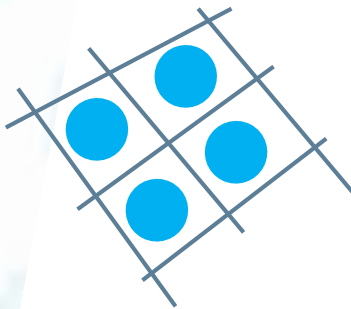
- malting
- cooking

unroll the starch and dissolve it in water

- heat and water

enzymes convert the starch to sugar

glucose



Alcoholic fermentation

Aim

- to create ethanol and congeners

Ethanol

- sugar + yeast → ethanol + carbon dioxide (CO₂) + heat

Congeners

- other alcohols (methanol, fusel alcohols)
- esters (fruity)

Alcoholic fermentation

Yeast

- typically selected yeast
batch consistency
- ambient yeast
complexity

Measuring ethanol

- abv = alcohol (ethanol) by volume
10% abv = 10% of volume is ethanol
- US proof = 2 x abv
80 proof = 40% abv

Aim

- select and concentrate ethanol and some congeners

Newly made spirits

- colourless and dry

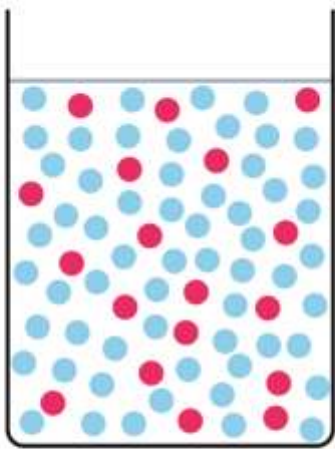
Terminology

- fraction
- congener



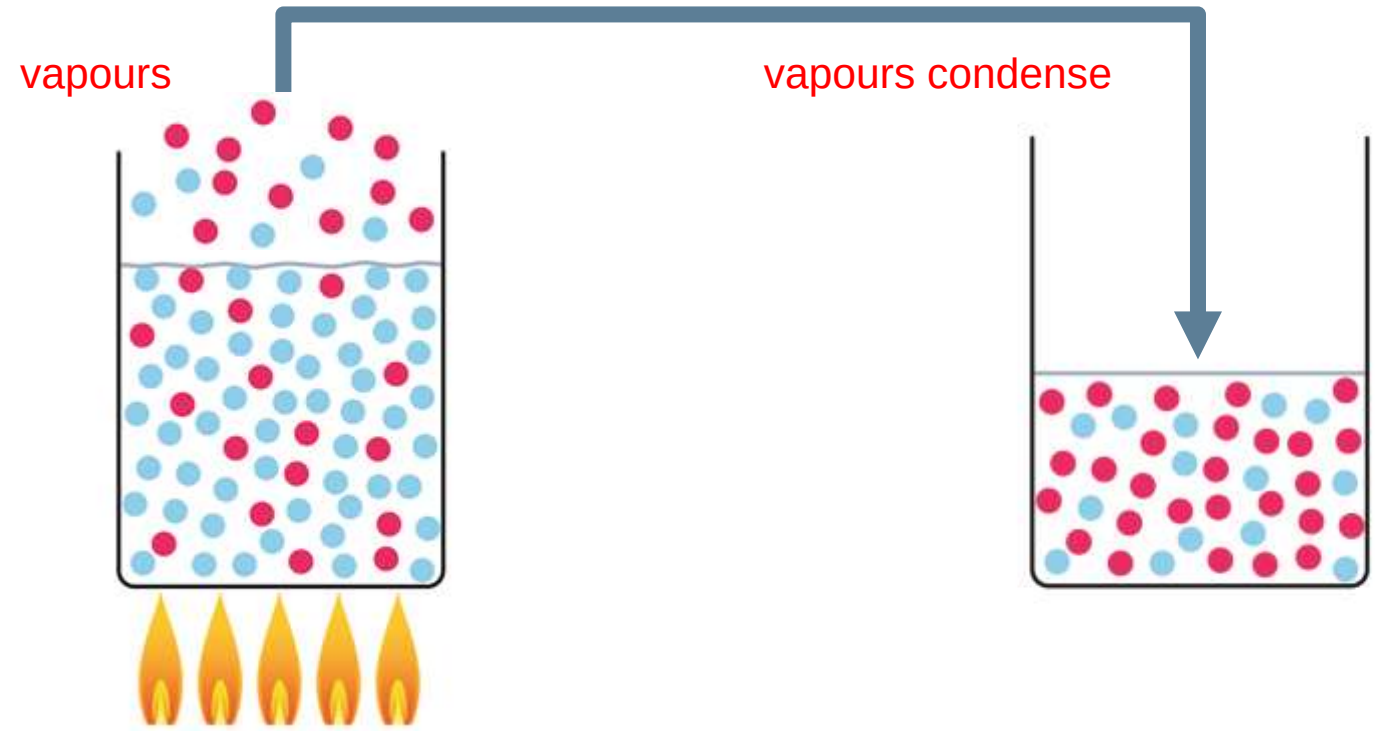
The theory of distillation

water/ethanol mix



Volatility

- water 100°C
- ethanol 78.3°C



Boil & vapourise

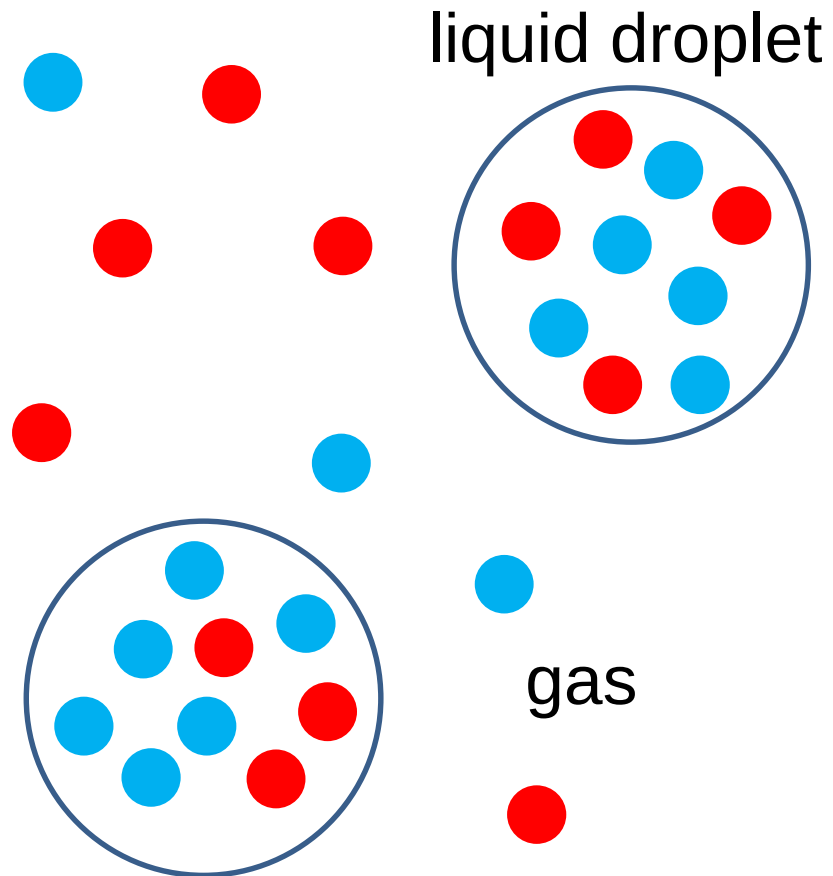
- higher concentration of ethanol in the vapours

Condense

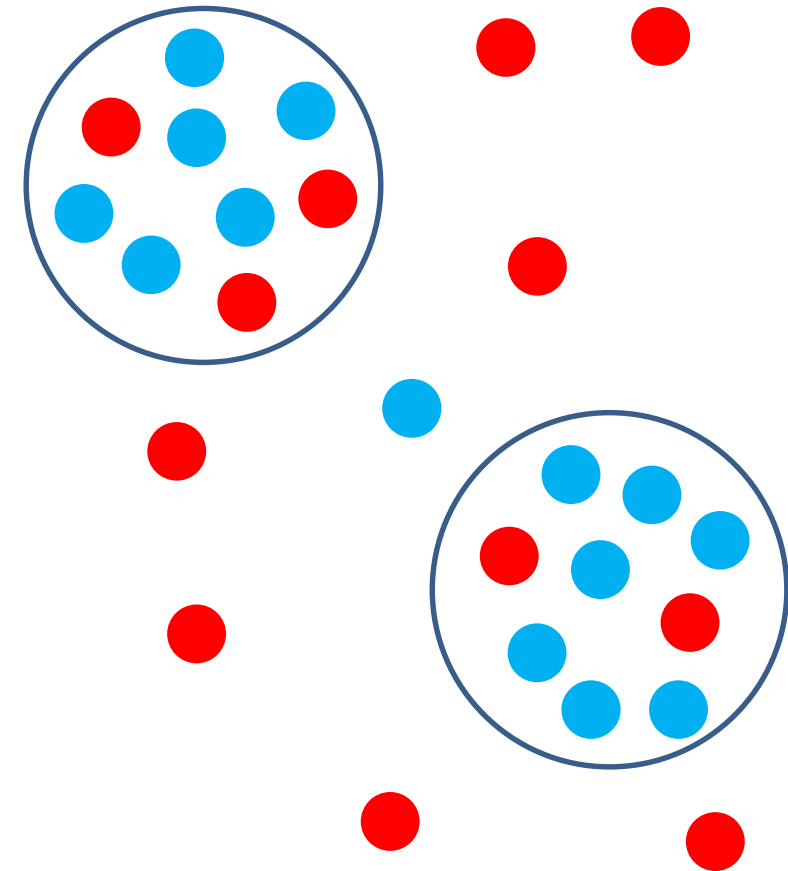
Reflux and rectification

water/ethanol mix

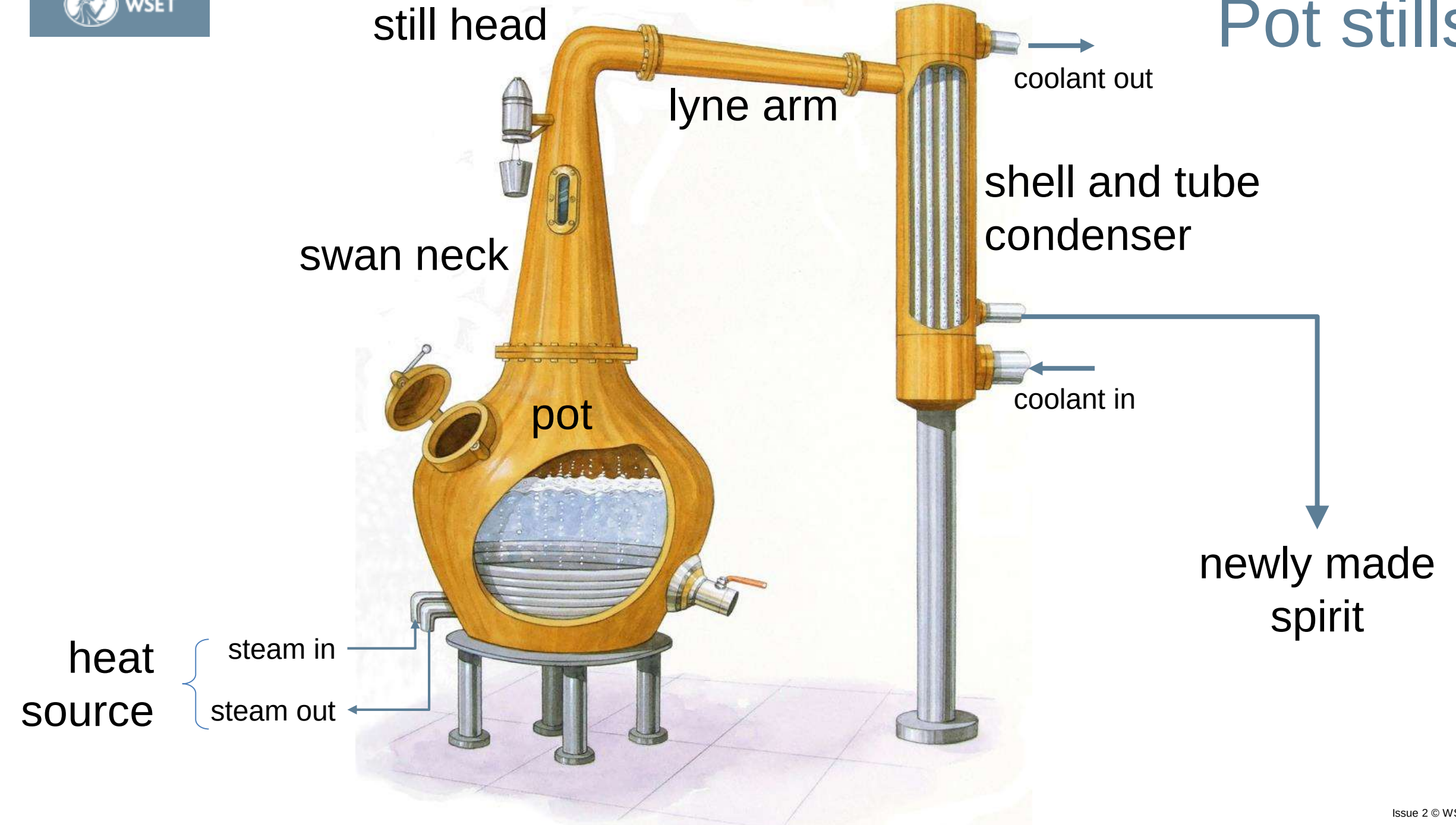
Before



After



Pot stills

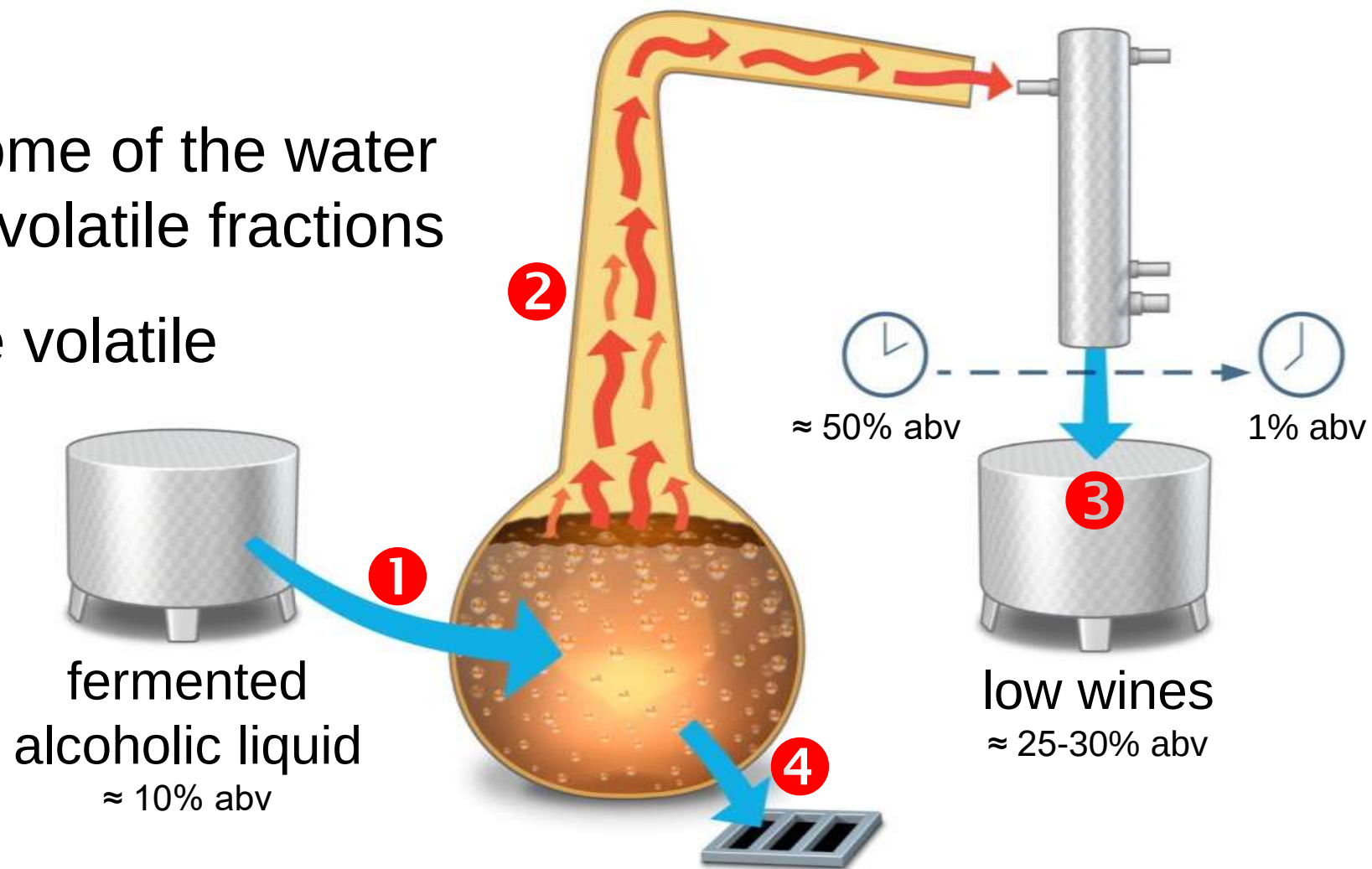


Double pot still distillation

1st distillation

Aim

- to remove some of the water and the non-volatile fractions
- collect all the volatile fractions

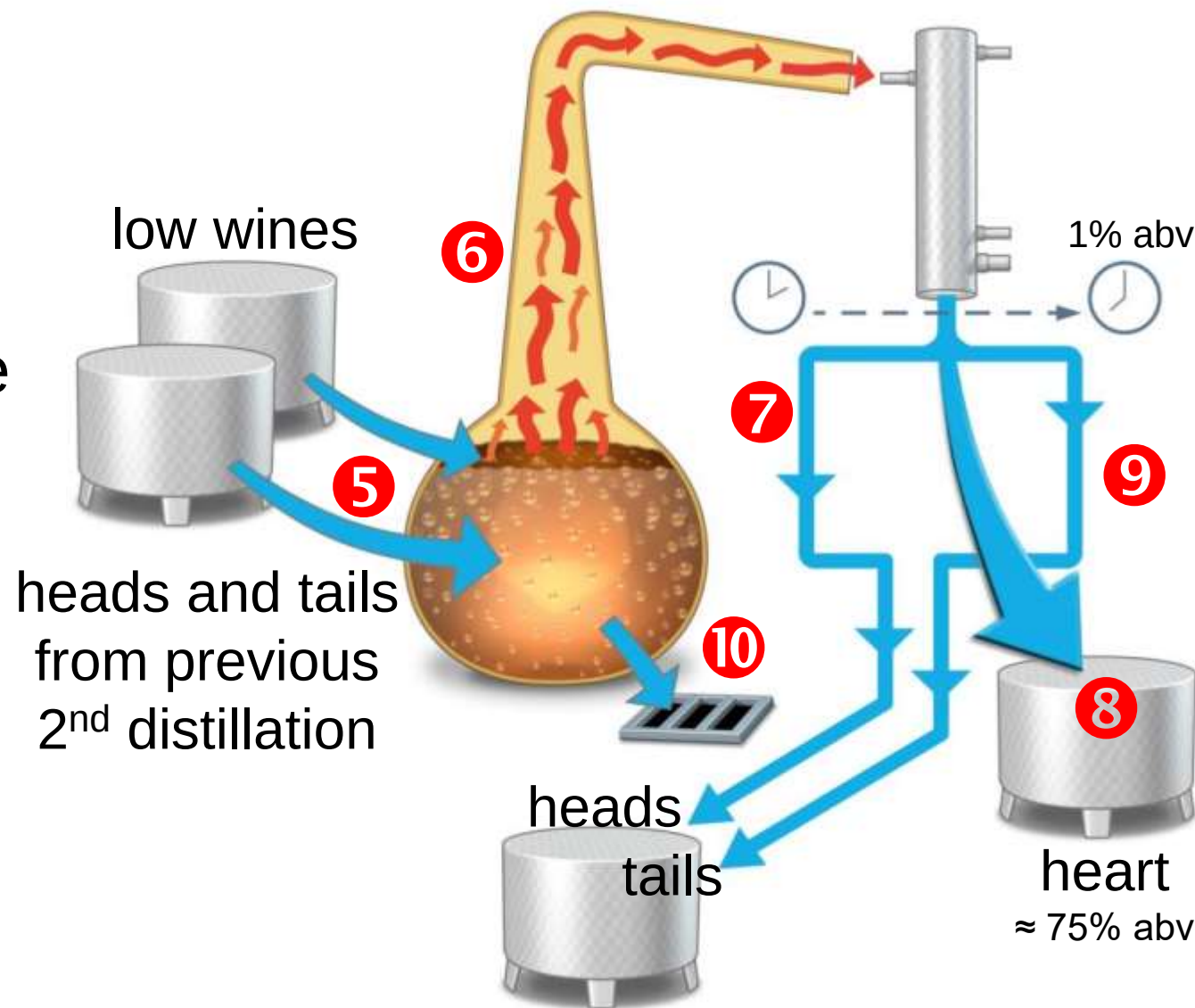


Double pot still distillation

2nd distillation

Aim

- to create a usable spirit
- select and concentrate ethanol and some congeners



Double pot still distillation

2nd distillation

Selection and concentration

- **Group 1 fractions**

fractions with boiling points much lower than ethanol
solvent smell when concentrated *e.g.* methanol

- **Group 2 fractions**

ethanol and fractions with a similar boiling point
the heart of the spirit

- **Group 3 fractions**

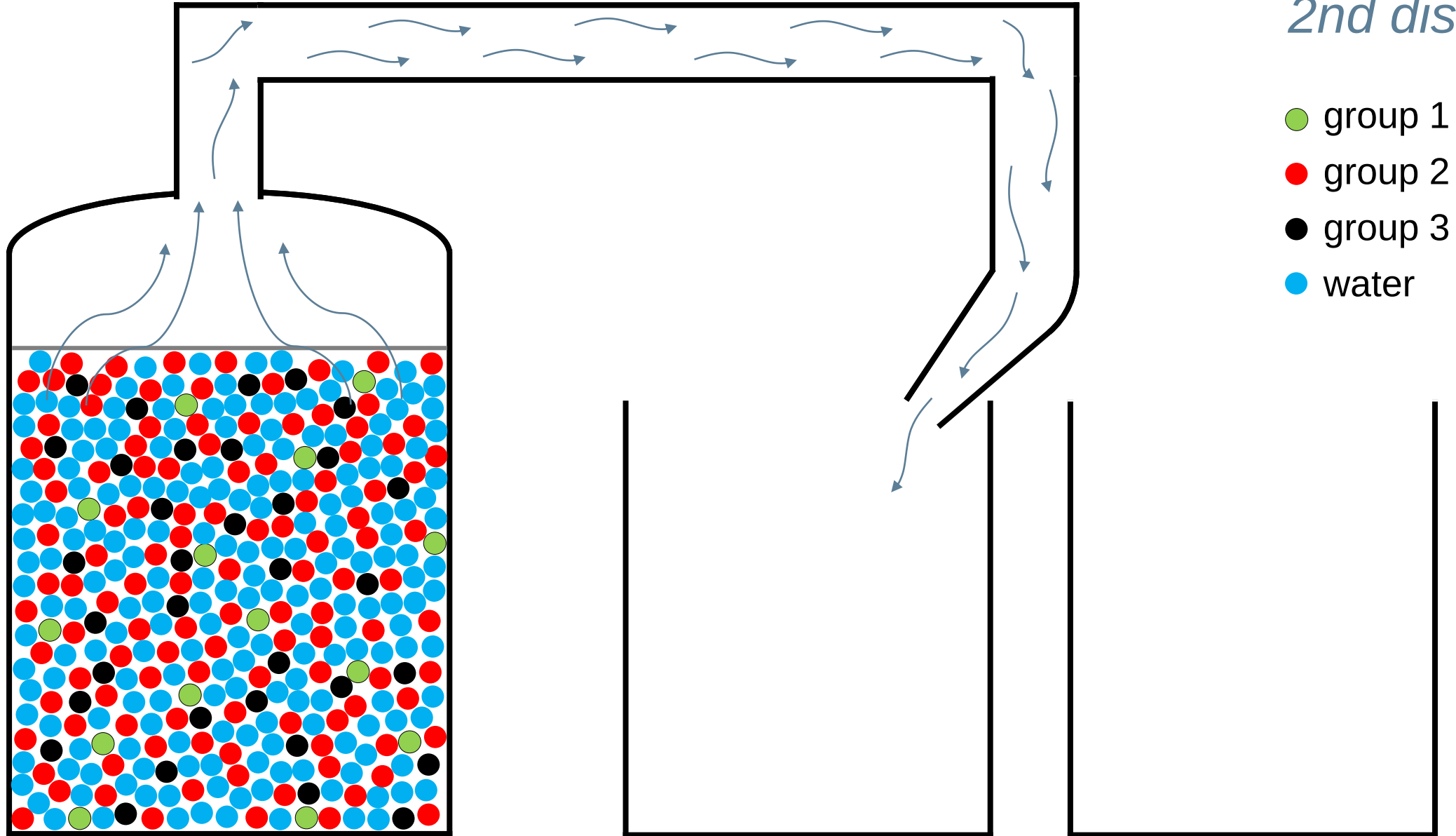
fractions with a boiling point much higher than ethanol
cheesy plasticity smell when concentrated *e.g.* fusel alcohols



some group 1 and
group 3 fractions
add complexity

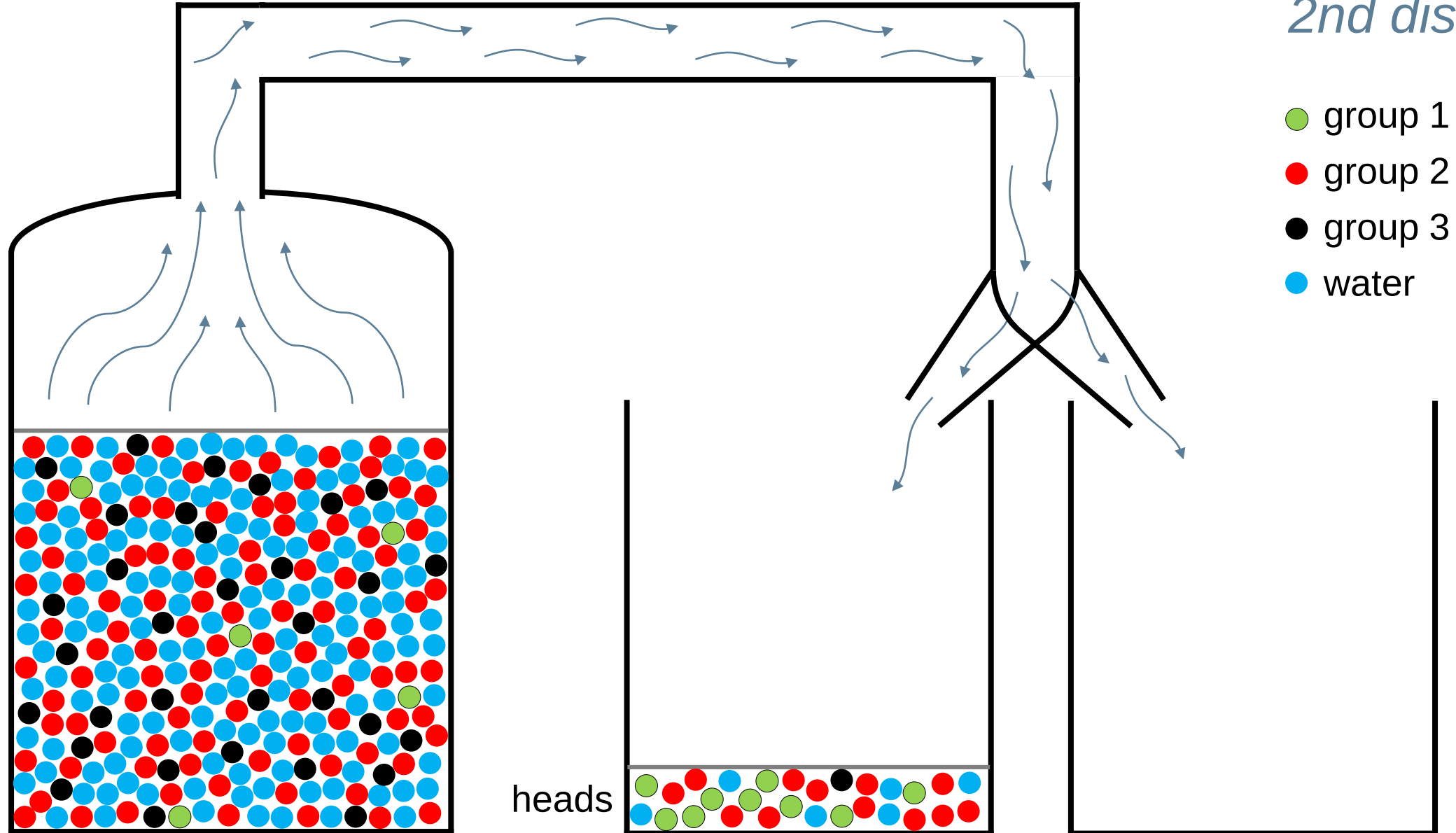
Double pot still distillation

2nd distillation



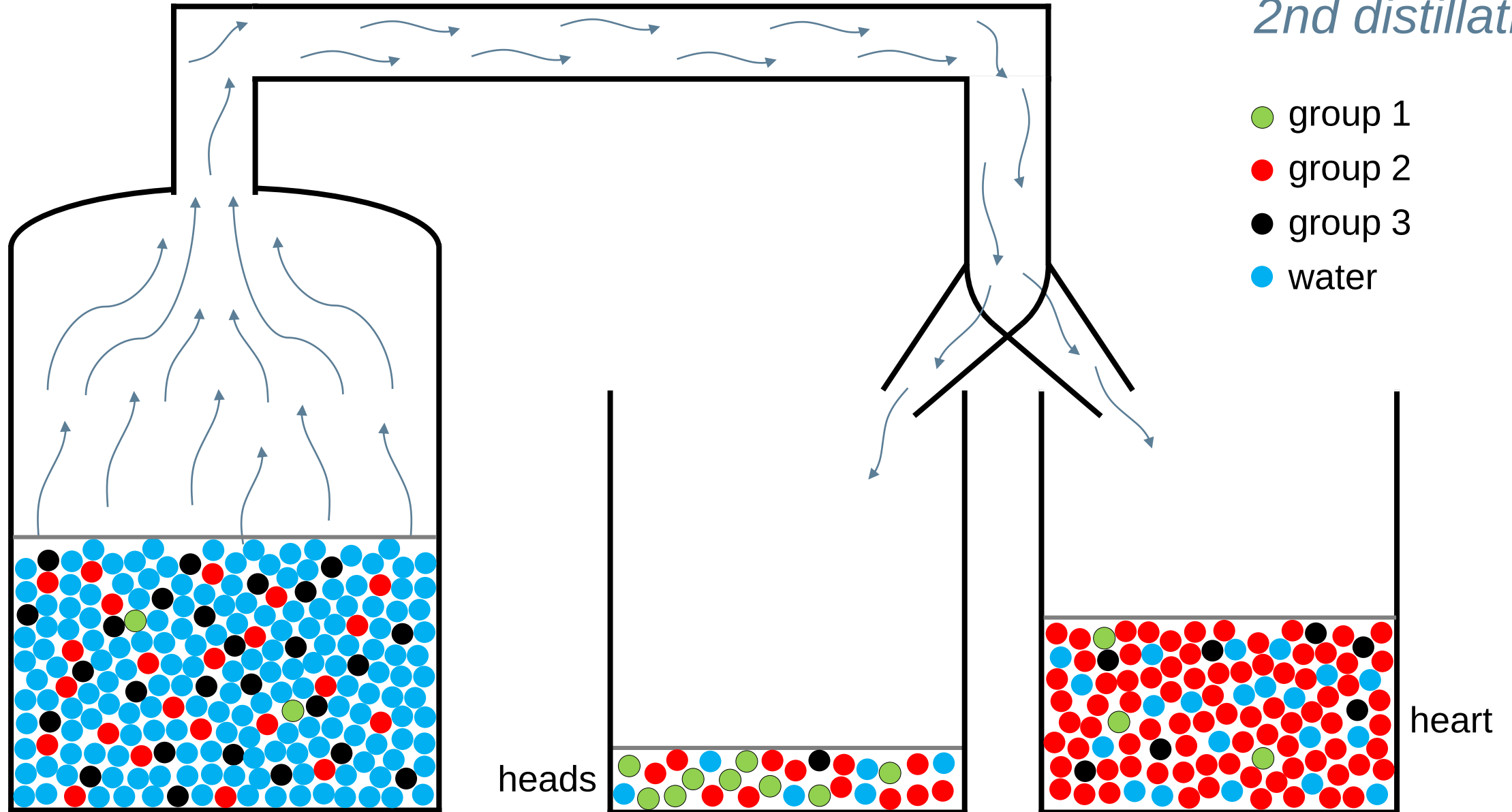
Double pot still distillation

2nd distillation



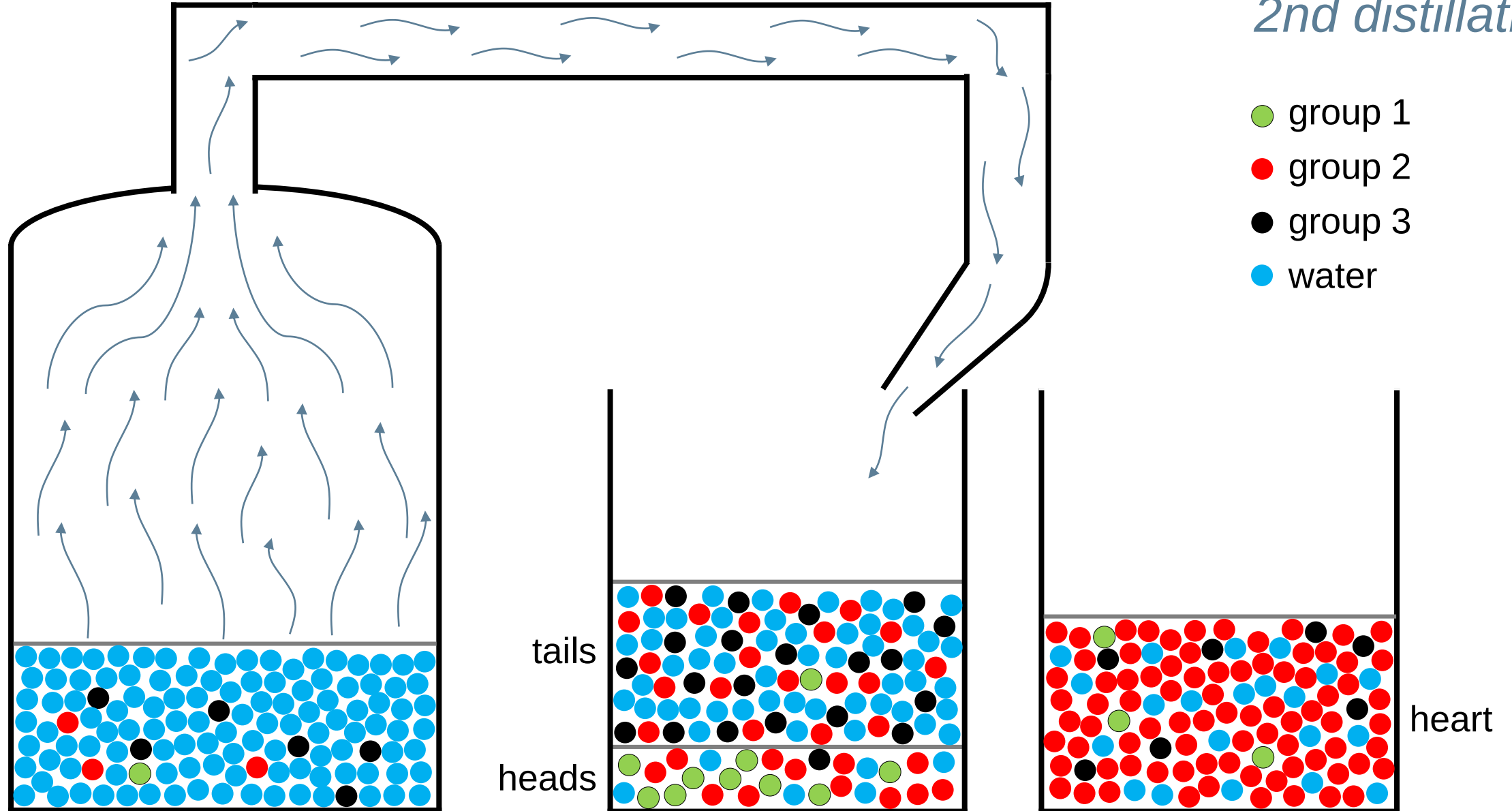
Double pot still distillation

2nd distillation



Double pot still distillation

2nd distillation



Double pot still distillation

2nd distillation

Selection and concentration

- **Group 1 fractions**
they are concentrated first in the heads
- **Group 2 fractions**
they are concentrated next in the heart
- **Group 3 fractions**
they are concentrated last in the tails

timing of the cuts is a
distiller's choice

recycle heads and tails to
reclaim group 2 fractions

Pot still spirits

- characterful (medium or pronounced intensity)

Pot stills and column stills

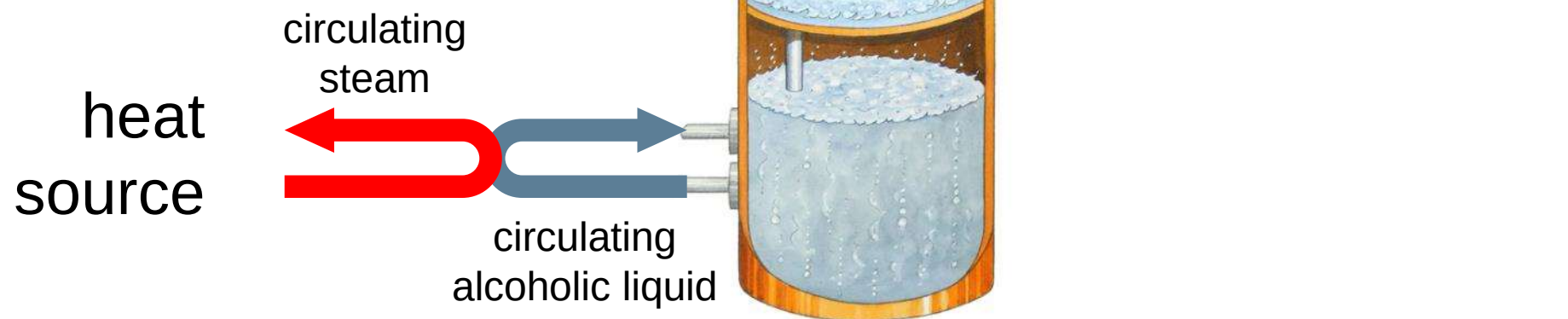
Pot stills

- method of operation
batch distillation
- type of spirits produced
produce characterful spirits with a
medium or pronounced intensity

cannot produce highly rectified
spirits

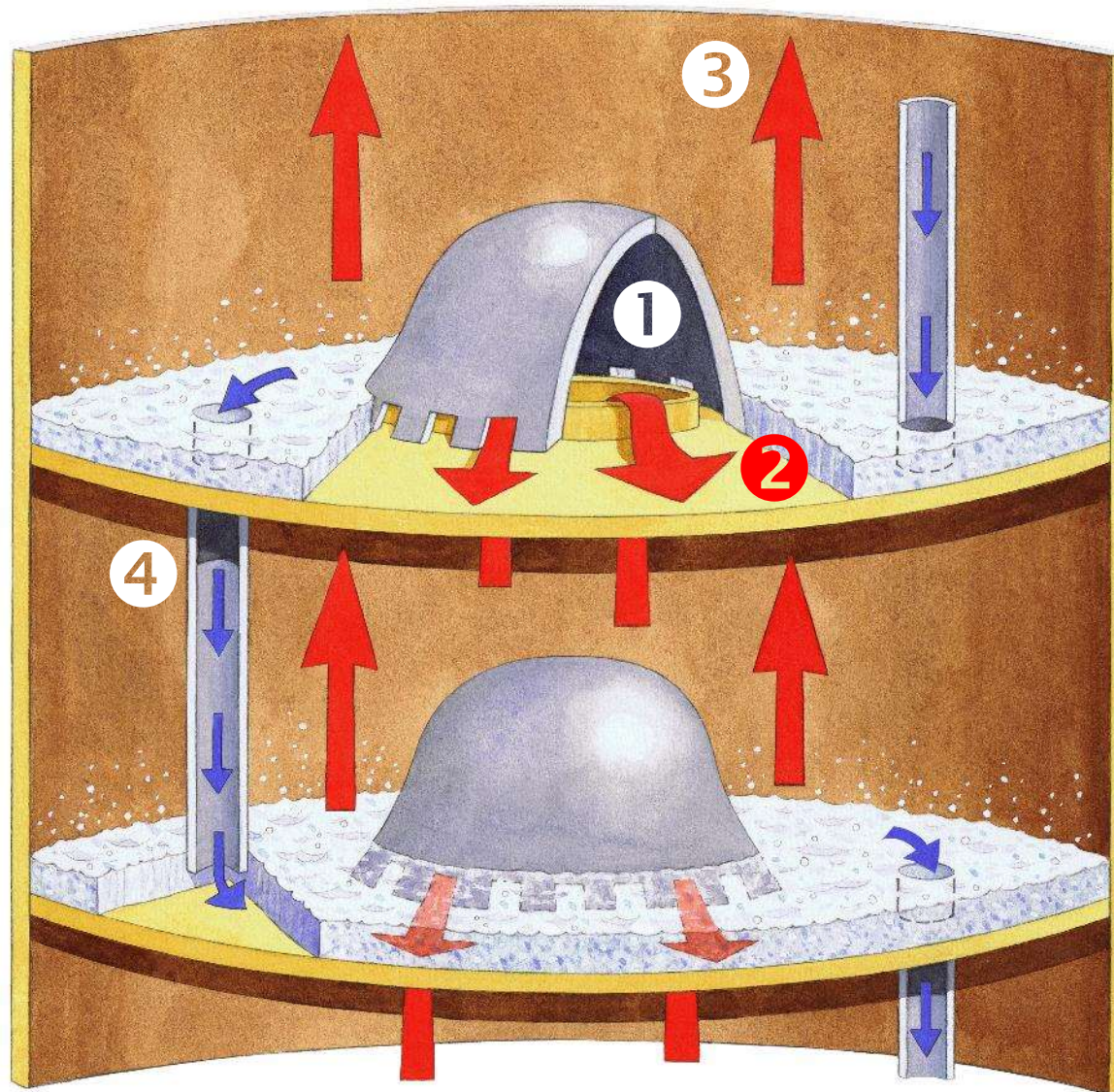
Column stills

Column stills



Plates

water/ethanol mix

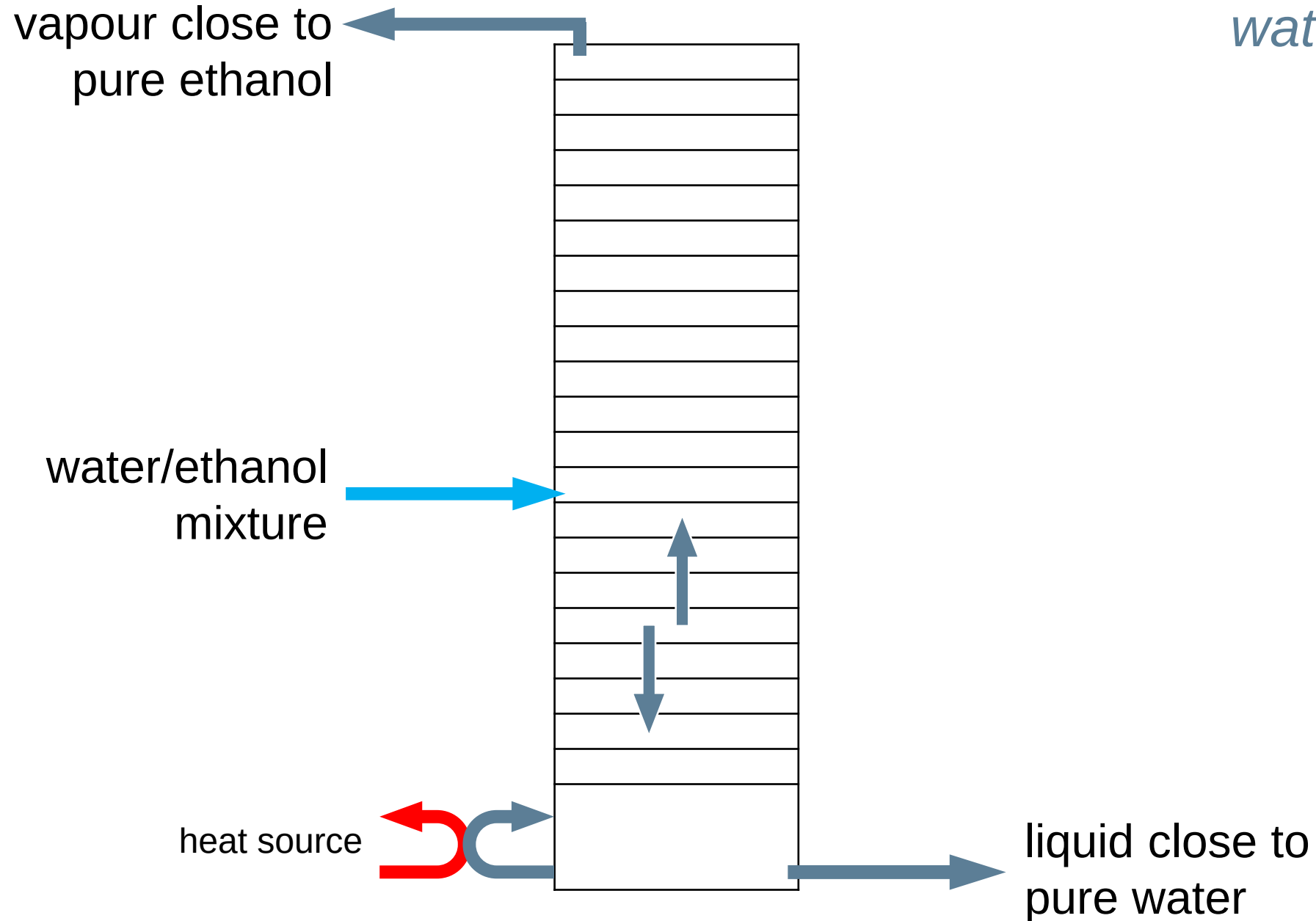


higher concentration of
ethanol in the vapours
rising up the still

higher concentration
of water in the liquid
flowing down the still

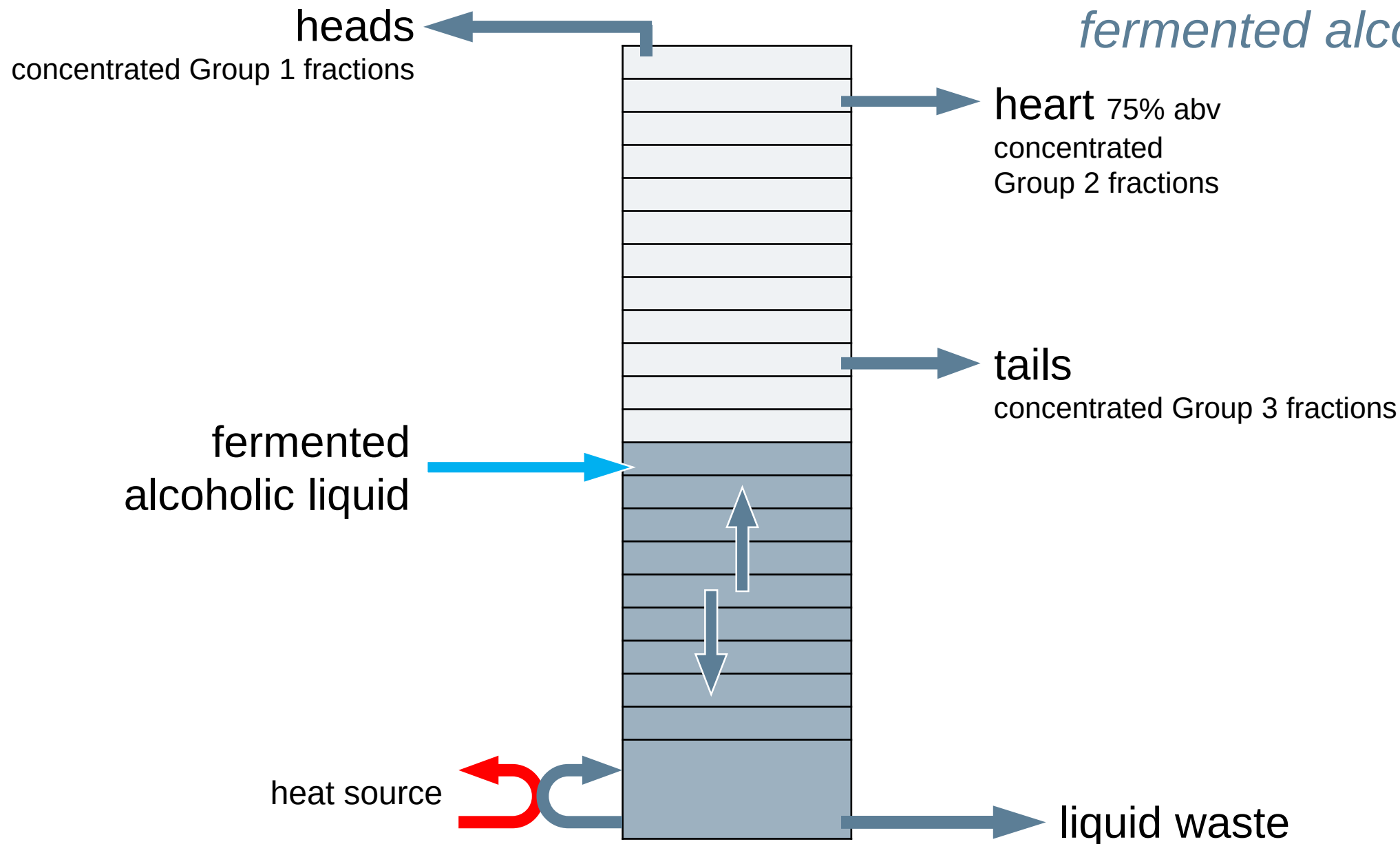
Column still distillation

water/ethanol mix

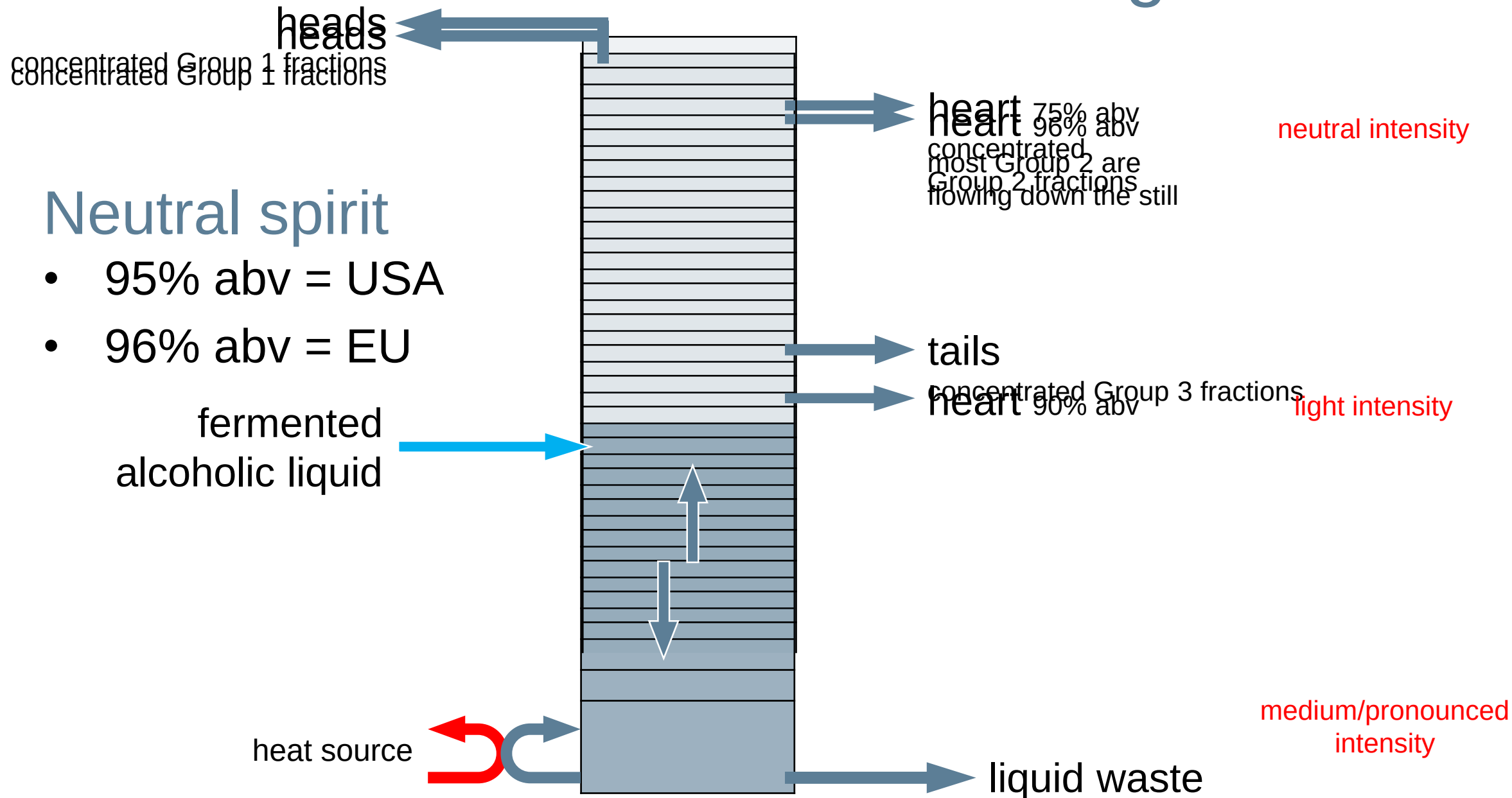


Column still distillation

fermented alcoholic liquid



Distillation strength & flavour



Pot stills and column stills

Pot stills

- method of operation
batch distillation
- type of spirits produced
produce characterful spirit with a medium or pronounced intensity

cannot produce highly rectified spirits

Column stills

- method of operation
can be run continuously
- type of spirits produced
can produce any style of spirit from low strength pronounced spirits to neutral spirits

Post-distillation operations

Key points

- storage and maturation in oak or inert vessels
covered in sessions 3 and 4
- adding flavours other than oak
covered in session 8
- blending
covered in session 4
- finishing
covered in sessions 4, 5 and 7